Average Recovery Time From a Standardized Intravenous Sedation Protocol and Standardized Discharge Criteria in the General Dental Practice Setting

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Intravenous sedation has been used in dentistry for many years because of its perceived advantages over general anesthesia, including shorter recovery times. However, there is limited literature available on recovery from intravenous dental sedation, particularly in the private general practice setting. The aim of this study was to describe the recovery times when sedation was conducted in private dental practice and to consider this in relation to age, weight, procedure type, and procedure time. The data were extracted from the intravenous sedation records available with 1 general anesthesia–trained dental practitioner who provides ambulatory sedation services to a number of private general dental practices in the Perth, Western Australia Metropolitan Area. Standardized intravenous sedation techniques as well as clear standardized discharge criteria were utilized. The sedatives used were fentanyl, midazolam, and propofol. Results from 85 patients produced an average recovery time of 19 minutes. Recovery time was not associated with the type or length of dental procedures performed.

Key Words: Sedation; Dental care; General practice.

INTRODUCTION

Intravenous (IV) sedation has been used in dentistry for many years.[1,2] One of its many perceived advantages over general anesthesia is the shorter recovery times attributed to this modality of pain and anxiety control.[3,4] Other advantages include less patient preparation, reduced monitoring equipment requirements, and less stringent training for the personnel involved. However, most available studies of recovery times compare different drug protocols and were undertaken in controlled circumstances, such as hospitals and university medical centers, and not in the primary care setting.[5] The studies available are not clear on the discharge criteria utilized. For example, many such studies simply do not state the criteria that are applied,[6,7] or they use discharge criteria that are inappropriate for sedation in the dental general practice setting such as modified Romberg and "P" tests.[8,9] This retrospective study was designed to examine the data available from the IV sedation records for an 18-month period available with 1 general anesthesia–trained dental practitioner (first author) who provides ambulatory sedation services to a number of private general dental practices in the Perth, Western Australia metropolitan area. The aim of this study was to describe the recovery times when sedation was conducted in private dental practice and to consider this in relation to age, weight, procedure type, and procedure time. A standardized IV sedation technique as well as clear standardized discharge criteria were utilized.

MATERIALS AND METHODS

All patients in this study were American Society of Anesthesiologists Category 1 and Category 2 patients under-

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going general dental treatment. Written informed consent for the IV sedation was obtained from patients or their guardian before starting the procedure. Patients or their guardians were issued a written list of presedation instructions. All patients were examined before sedation, and baseline vital signs were recorded. Vital signs were monitored during sedation, treatment, and recovery. Vital signs monitoring consisted of continuous pulse oximetry and pulse rate monitoring (INVIVO Model 4500; Invivo Research Inc, Orlando, Fla) as well as noninvasive blood pressure monitoring (Omron M4; Omron Corporation, Tokyo, Japan). This is the standard of monitoring required for patient safety and is consistent with the Policy document on sedation for dental procedures as agreed between the Royal Australasian College of Dental Surgeons and the Australian and New Zealand College of Anaesthetists.[10] Vital signs for each patient were recorded every 5 minutes during the procedures and during recovery. Patients were most often allowed to recover in the dental chair and were usually not moved until they were ready to be discharged. A standardized written medical questionnaire (Australian Dental Association, West Australia Branch) was also used as a screening tool to identify any medical risk before treatment.

A deep sedation technique was used to sedate the patients. In order to be included in the study, the patient must have received 3 drugs administered during the sedation (fentanyl, midazolam, and propofol). Fentanyl is a short-acting opioid used to raise the patient's pain threshold and to induce moderate sedation. Midazolam is a benzodiazepine that possesses sedative, amnestic, and muscle relaxant properties. Propofol is considered as an hypnotic in high doses but is used for its sedative and antiemetic effects in low doses.[11–13] All the drugs used have very short alpha half-lives. A total of 112 patient records was examined for this study, and 86 patients met these criteria. One patient in this latter group was excluded from the study because this patient's escort was delayed and was not available when the patient was ready for discharge; thus, this patient's discharge time could not be reliably calculated. Eighty-five cases were therefore included in the study. After application of the monitors and application of a nasal hood attached to a nitrous oxide/oxygen apparatus delivering a minimum of 50% oxygen, an infusion of normal sterile saline or 0.45% saline and 2.5% glucose was started via a vein in the upper extremity. A 20- or 22-gauge indwelling catheter (Optiva Brand; Johnson & Johnson, Brussels, Belgium) was used in all cases. Baseline sedation was obtained using 100 μg of fentanyl. A 25-μg test dose was given, and after a 90-second wait, the remainder of the fentanyl was administered. After a further 2-minute wait, midazolam was then titrated (to a maximum of 5 mg) to slurring of speech as the end point of sedation. If this end point was not reached, 10-mg boluses of propofol were then administered to achieve this end point. At this point, the treating dentist was invited to administer local anesthesia. Occasionally, a 10-mg bolus of propofol was utilized to "cover" the administration of the local anesthetic. This was considered to be the start time of the procedure. Supplementary sedation, as dictated by the patients' condition (movement, phonation, etc) or stage of procedure (vital pulp extirpation, elevation of impacted tooth, etc), was achieved by the use of 10-mg boluses of propofol as required. For cases in which procedure time was planned to go over 90 minutes, one-half the initial dose of midazolam was administered after 45 minutes.

All data generated were entered on an Excel spreadsheet and data manipulation conducted in Microsoft Excel and Stata 5. Discharge time was calculated from the time the operating dentist indicated that he or she had finished his or her procedures to the time the patient left the surgery proper. Patients were monitored during the recovery period as for their procedure. Patients breathed 100% oxygen via a nasal hood for the first 5 minutes of recovery time. Vital signs were recorded every 5 minutes. Patients were required to achieve a score of 10 out of 10 to be discharged. A modified Aldrete postanesthetic score was used to determine the patient's readiness for discharge.[14] The following criteria and scoring were used:

- Patients' vital signs (ie, blood pressure, pulse) had to be within 20% of their baseline values, oxygen saturation within 2% of preoperative values—2 points
- Patients had to be oriented as to self, place, day, and date and also had to respond appropriately to verbal questioning—2 points
- Patients had to be able to walk without assistance (where appropriate)—2 points
- Patients were required to be able to take a deep breath and cough on command—2 points
- Patients had to exhibit normal skin color and appearance—2 points

All patients' escorts or their guardians were issued written postsedation instructions just before discharge. The postsedation instruction sheet contained an emergency contact number, should the need arise.

RESULTS

Patients included in the study ranged in age from 15 to 66 years, with an average of 37.8 ± 12.1 years. Weights ranged from 43 to 120 kg, with an average of 75.8 ± 15.4 kg (the Table). The majority were American Society of Anesthesiologists Category 1 and Category 2 patients (98%). Procedures undertaken included conservative dentistry, endodontic procedures, post and core preparations, crown preparations and impression, impressions for par-

Description of Participants

	Range	*Mean*
Variable		
Age (y)	15–66	38
Weight (kg)	43–120	76
Gender	30 Male, 55 female	
Procedures		
Category 1	42 Patients	
Category 2	43 Patients	

tial dentures, prophylaxis, simple extractions, surgical extractions, first stage implant placements, and regenerative membrane placement. Procedures carried out were considered in 2 broad categories. Category 1 included all surgical procedures including extraction, whether simple or impacted, implant placement, regenerative membrane placement, and implant procedures. Category 2 included all prosthetic-restorative procedures and prophylactic procedures. As would be expected in the general practice setting, there were overlaps in the category of procedures undertaken. If the procedures included items from both categories, the predominant procedures determined the categorization. Procedure times ranged from 8 to 185 minutes, with an average of 71.4 ± 37.5 minutes (median 64 minutes). Patients received 75–100 μg of fentanyl, with mean 99.7 μg and SD 2.8 (median 100 μg), 3–15 mg of midazolam, with mean 5.9 mg and SD 1.9 (median 5 mg), and 10 mg (N = 4) to 400 (N = 2) mg propofol, with mean 137.2 mg and SD 89.0 (median 120 mg). There were 30 males and 55 females enrolled in this study, with a female to male ratio of 1.8 : 1. Overall mean recovery time was calculated to be 19.0 ± 5.5 minutes (median 17 minutes). Male and female recovery times were considered separately, but there were no differences in recovery by gender (males, 19.2 ± 5.2 minutes, median 18 minutes; females, 18.9 ± 5.7 minutes, median 17 minutes). Recovery time was also considered by length of procedure, and there was no linear relationship (Figure 1). However, that there was a tendency to "release" patients after either 15 or 20 minutes may be related to the fact that vital signs were assessed every 5 minutes. Recovery time by age (Figure 2), weight (Figure 3), and type of procedure (Figure 4) was also examined with no discernable relationship found between the variables. Complications encountered during the sedations were negligible, and most were related to the IV access.

DISCUSSION

This study offers confirmation that IV sedation techniques utilized in the general practice setting are a modality of pain and anxiety control that is amenable to the short turnover times encountered in general practice. Even the use of strict discharge criteria did not seem to have an impact on the recovery time in this study. Patients recovered within a minimal amount of time and were street fit and capable of being discharged in a relatively brief time span. The recovery times obtained were consistent with the short turnover times encountered in private general prac-

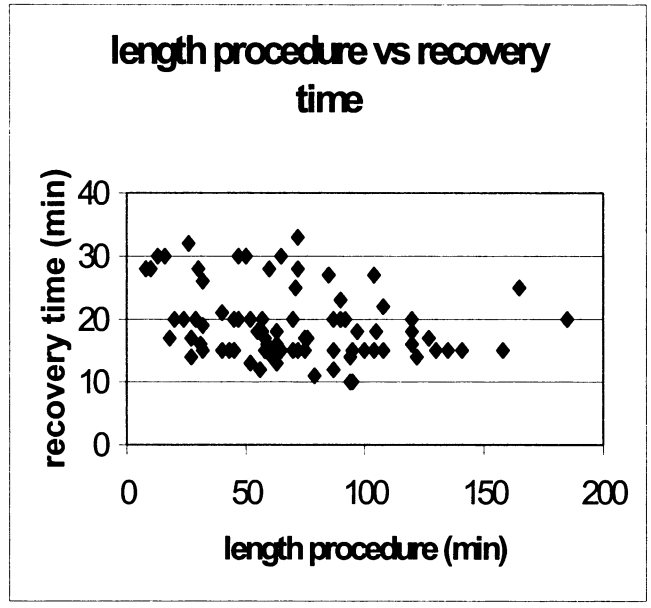

Figure 1. This figure demonstrates the lack of relationship between length of procedure (minutes) and recovery time (minutes).

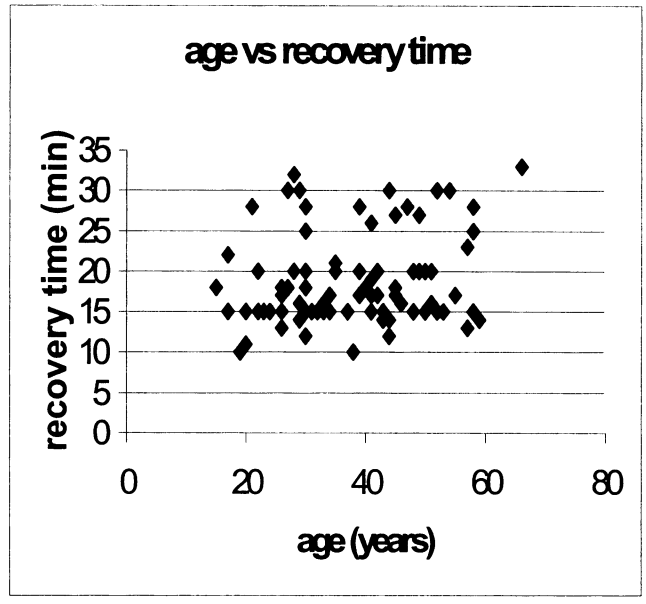

Figure 2. Graph showing lack of relationship between age (years) and recovery time (minutes).

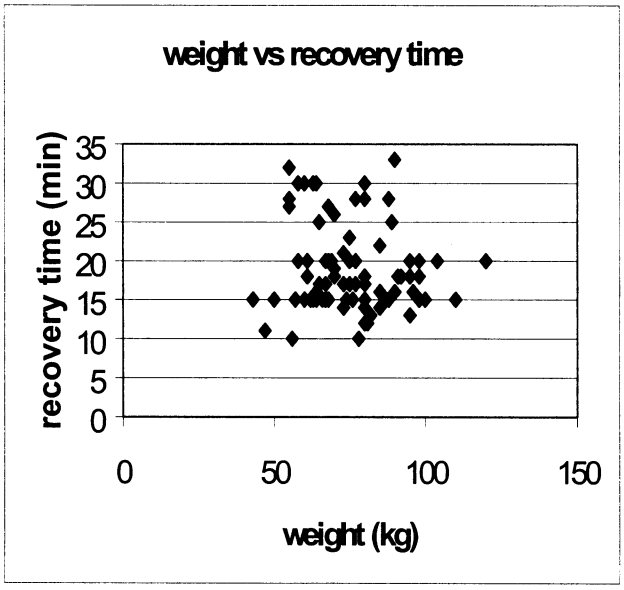

Figure 3. This scattergram shows weight (kg) versus recovery time (minutes).

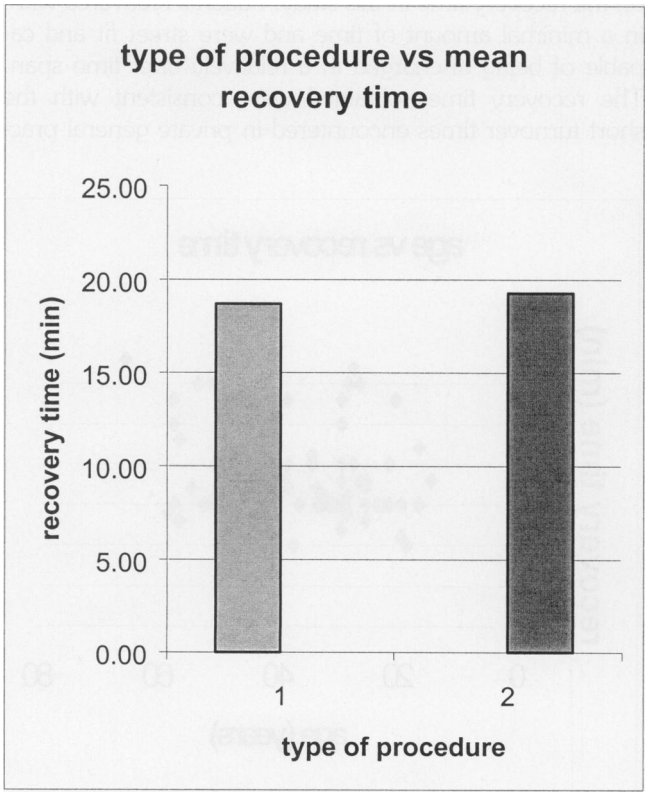

Figure 4. Type of procedure is not related to recovery time (minutes).

tice. Neither procedure length and complexity nor patient age or weight seemed to have an impact on the recovery times encountered in this study. The use of appropriate discharge criteria allows for the discharge of the patient when he or she is physiologically ready. Previous studies used discharge criteria that were either vague or inappropriate.[15] Unlike general surgery, where the effects of the procedures may have a major influence on recovery and discharge, dental procedures are much less invasive and in the general dental practice setting do not generally influence recovery speed and discharge time. Anecdotally, operating conditions were improved for the operating dentists, and many commented that the procedures took less time than they had anticipated. It would be interesting to compare these results with those obtained from a larger institutional center that administered ambulatory IV sedation for the full range of general dental practice as opposed to the more generally studied oral surgery model. These results suggest that the technique utilized here is appropriate to the general practice milieu in the hands of a properly trained dental sedation provider.

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